

**Declaration of Amendment Made in  
accordance with  
PCT Article 19(1)**

“The heat exchange apparatus ” in the claim 1 in this amendment is changed as “the heat exchange apparatus with multiple layers arranged crisscrossly.” This technical feature is a summary for the features of the structure described in the 22<sup>nd</sup> ~23<sup>rd</sup> line of the 1<sup>st</sup> page and the 1<sup>st</sup> line of the 2<sup>nd</sup> page and is supported by some concrete illustrations. The technical effects of this invention is realized by means of this technical feature.

All of the technical features in claim 1 after amendment have not completely published in the contrast documents D1 and D2, so it has novelty.

The functions of the heat exchange apparatus published in the technical solutions of the contrast documents D1 and D2 are piling up and heating the sand at it flowing state, but the role of the heat exchange apparatus with multiple layers arranged crisscrossly is to disperse the sand and slow down the falling speed of the sand. The mode of heating and the efficiency of the heating exchange apparatus with multiple layers arranged crisscrossly have changed substantially in this invention.

In the contrast documents, the sand piles up on the flow plate to form flowing sand layer and is heated directly through the flame spraying out from the burner. This mode of heating sand can heat a part of sand only, and the sand may be prone to coagulate into lumps and plug up the flow plate. However, in this invention, the sand is heated mainly by conduction of the hot air other than heated directly by the flame. Falling time and path of the sand are extended through number of holes which are arranged from up to down in the heat exchange apparatus. So, the sand is dispersed and the area for heat exchanging is increased significantly and sufficient heat exchange between the sand and heated air stream arising from the bottom of the furnace is carried out. It improves the heating efficiency. Therefore, the technical solutions claimed in claim 1 is not obvious and it is creative.

The additional technical feature in claim 6 is illustrated in the figure and the implementing example in the description. This additional technical feature makes the inclined side of the sand face the burner, contact with the flame directly, so it further heat the sand at high temperature.

### **Amendment notes**

Total 9 claims after the original 10 claims were amended.

Claim1 to Claim3, Claim5 to Claim9 are replaced by the respective Claims with the same numeric.

Claim4 is kept unchanged, Claim 10 is deleted.

## Claims

What is claimed is:

1. A casting sand heating apparatus, comprising a furnace body, sand inlet, smoke discharge and dust removing port, hearth and sand outlet, wherein the sand inlet is arranged at the top of the furnace body, the combustion mouth is arranged in the lower part of the furnace body, in addition, a multi-layer heat exchange apparatus is arranged crisscrossly in the middle part of the furnace body.
2. The casting sand heating apparatus of claim 1, wherein the multi-layer heat exchange apparatus is comprised of multi-layer crisscrossly arranged laths.
3. The casting sand heating apparatus of claim 1, wherein the multi-layer heat exchange apparatus is comprised of multi-layer partitions with sieve holes.
4. The casting sand heating apparatus of claim 1, wherein the multi-layer heat-exchange apparatus is comprised of multi-layer crisscrossly arranged laths of casting refractory material.
5. The casting sand heating apparatus of claim 1 or 2 or 3 or 4, wherein a sand inlet guidance apparatus is installed on the sand inlet.
6. The casting sand heating apparatus of claim 5, wherein the sand outlet is arranged at the bottom of the furnace body and near the side of the combustion mouth.
7. The casting sand heating apparatus of claim 6, wherein a dust removing duct is connected to the smoke discharge and the dust removing port, a cold air duct is connected to the dust removing duct.
8. The casting sand heating apparatus of claim 7, wherein a smoke return duct is installed at the outside wall of the furnace body, one end of the duct is connected to the dust removing duct, the other end is connected to the upper side of the combustion mouth on the wall of the furnace, a smoke circulating power apparatus is installed in the smoke return duct.
9. The casting sand heating apparatus of claim 8, wherein a check door is arranged on the lower part or at the bottom of the furnace body.